100

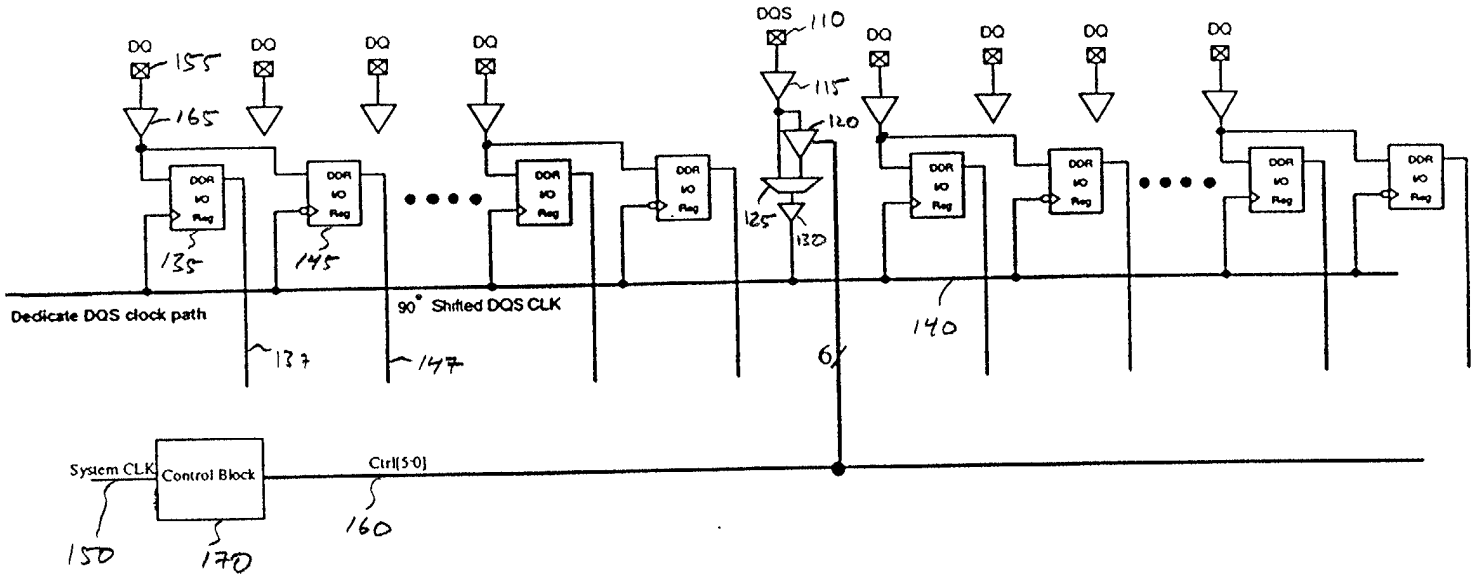

DQ
155
165
DQS
110
115
120
125
130
DDR IO Reg
135
145
Dedicate DQS clock path
90° Shifted DQS CLK
137
147
140
System CLK
Control Block
Ctrl[5:0]
150
170
160

FIGURE 1

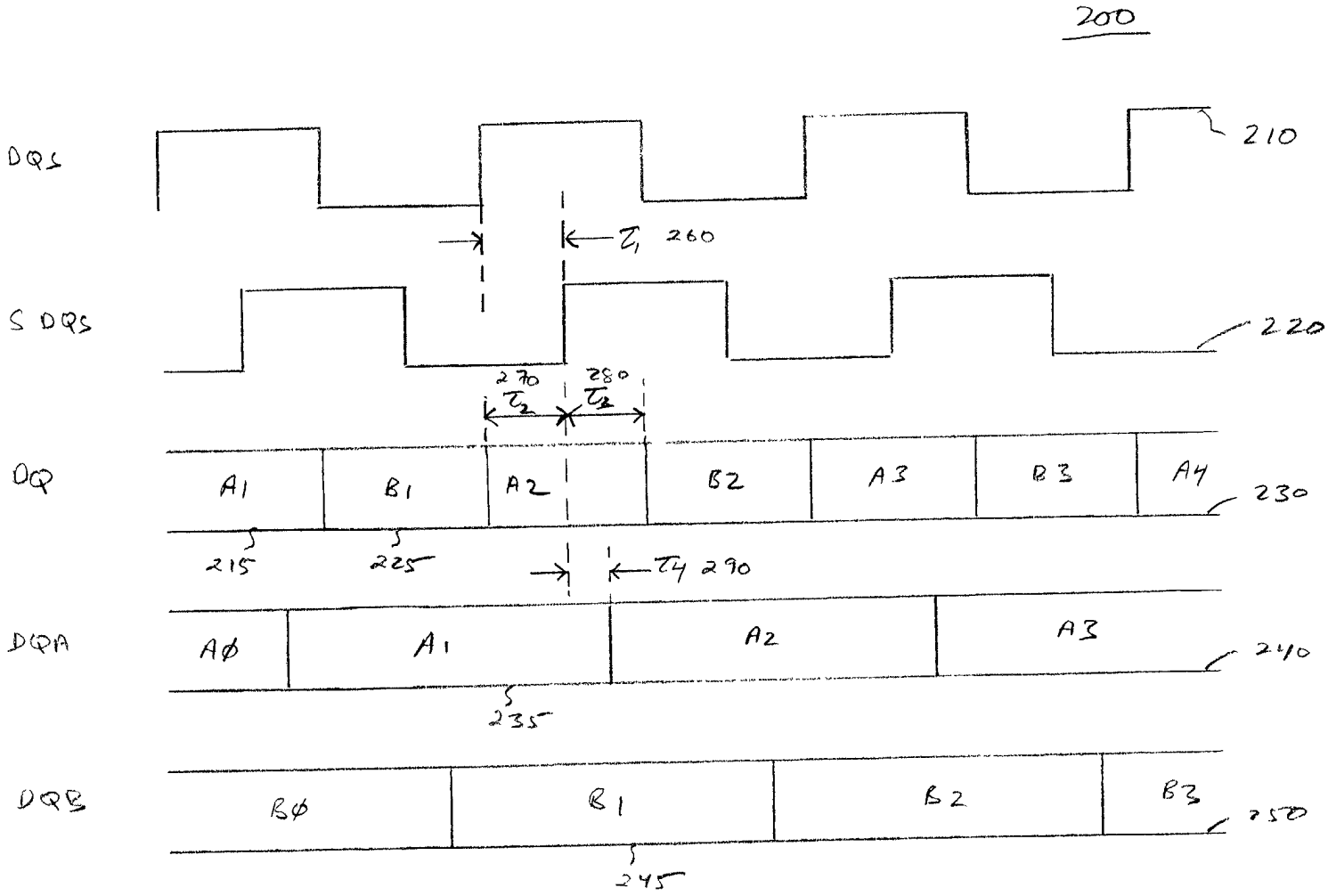

200
DQS
210
T_1 260
S DQS
220
270 T_2
280 T_3
DQ
A1
B1
A2
B2
A3
B3
A4
230
215
225
T_4 290
DQA
A∅
A1
A2
A3
240
235
DQB
B∅
B1
B2
B3
250
245

FIGURE 2

300

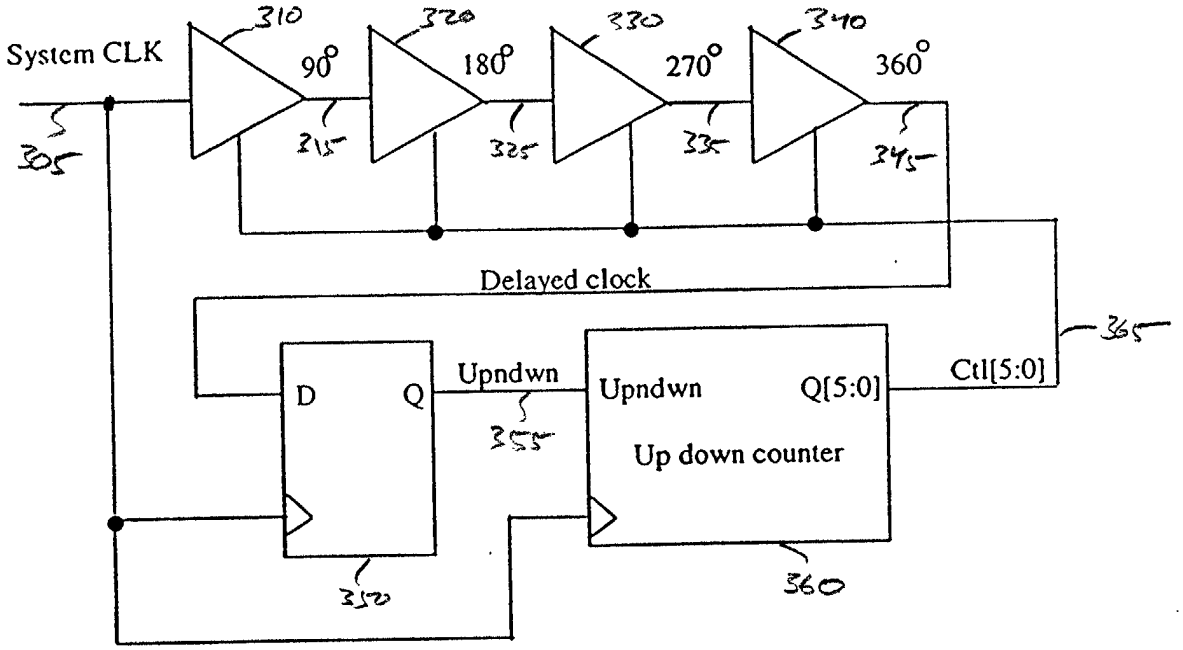

System CLK
310
320
330
340
90°
180°
270°
360°
315
325
335
345
305
Delayed clock
365
D
Q
Upndwn
355
Upndwn
Q[5:0]
Ctl[5:0]
Up down counter
350
360

FIGURE 3

20200 "T98/E00T

400

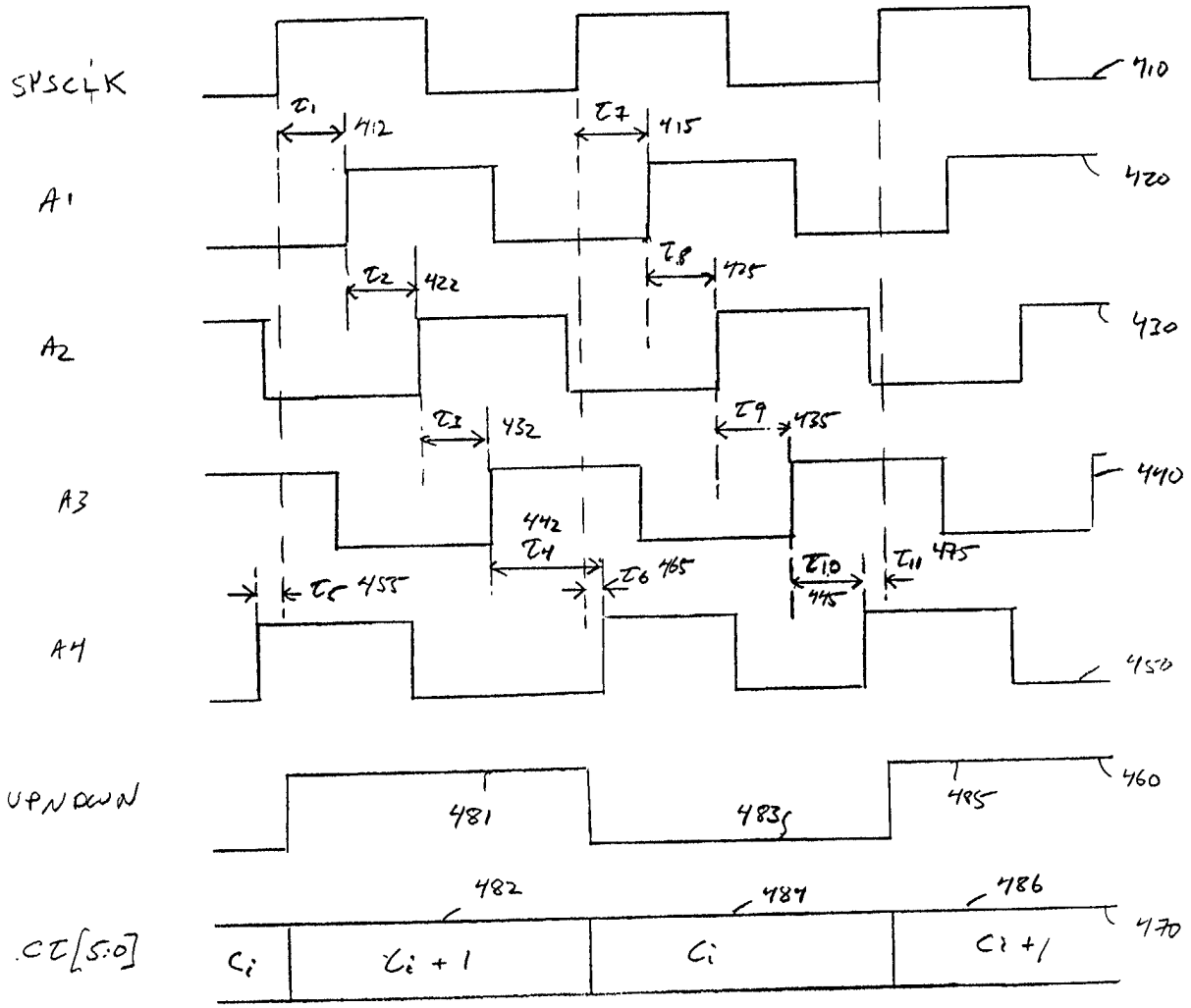


Figure 4

500

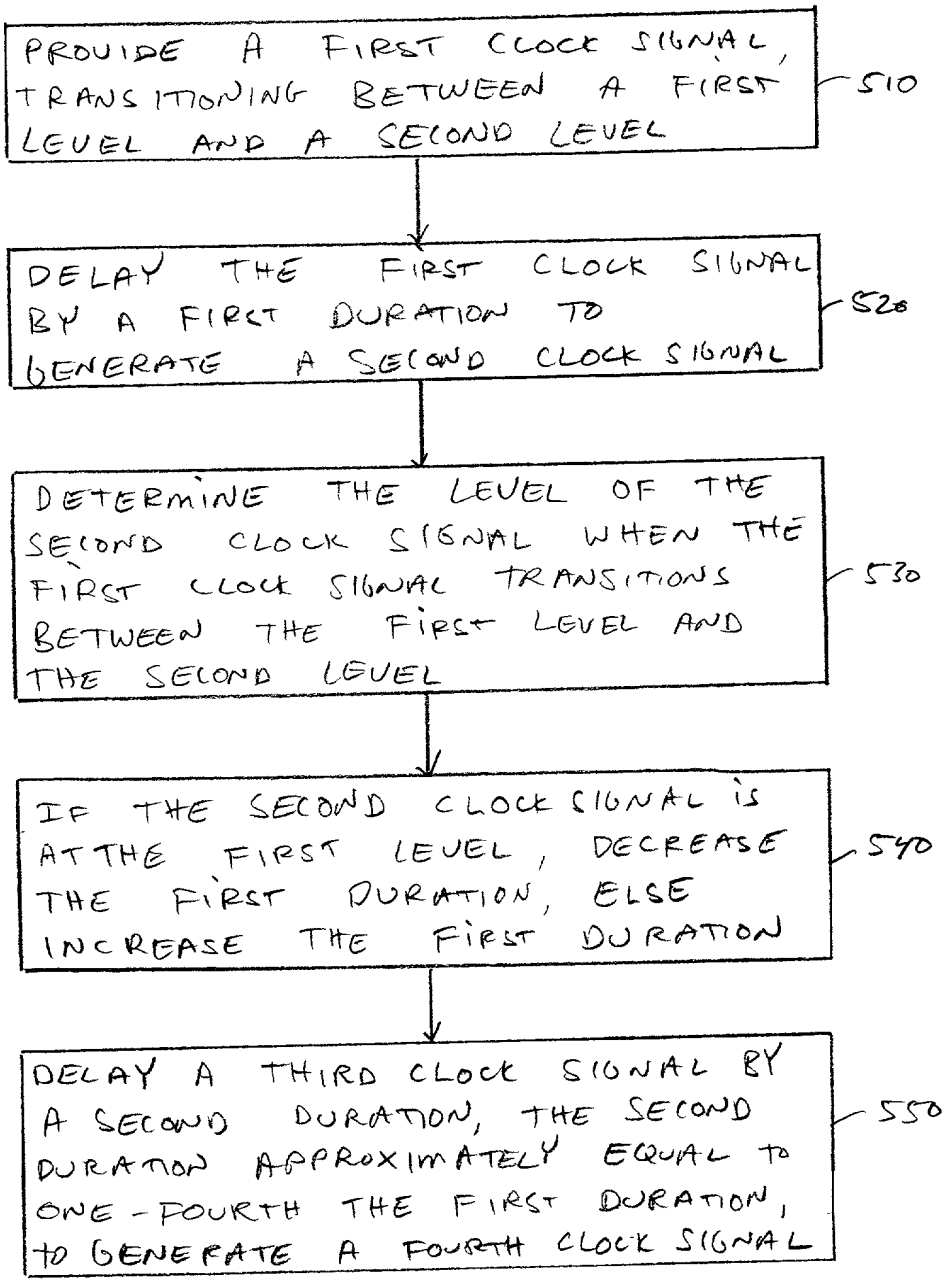

PROVIDE A FIRST CLOCK SIGNAL, TRANSITIONING BETWEEN A FIRST LEVEL AND A SECOND LEVEL
510
DELAY THE FIRST CLOCK SIGNAL BY A FIRST DURATION TO GENERATE A SECOND CLOCK SIGNAL
520
DETERMINE THE LEVEL OF THE SECOND CLOCK SIGNAL WHEN THE FIRST CLOCK SIGNAL TRANSITIONS BETWEEN THE FIRST LEVEL AND THE SECOND LEVEL
530
IF THE SECOND CLOCK SIGNAL IS AT THE FIRST LEVEL, DECREASE THE FIRST DURATION, ELSE INCREASE THE FIRST DURATION
540
DELAY A THIRD CLOCK SIGNAL BY A SECOND DURATION, THE SECOND DURATION APPROXIMATELY EQUAL TO ONE-FOURTH THE FIRST DURATION, TO GENERATE A FOURTH CLOCK SIGNAL
550

FIGURE 5

20207O" T98ZE90T

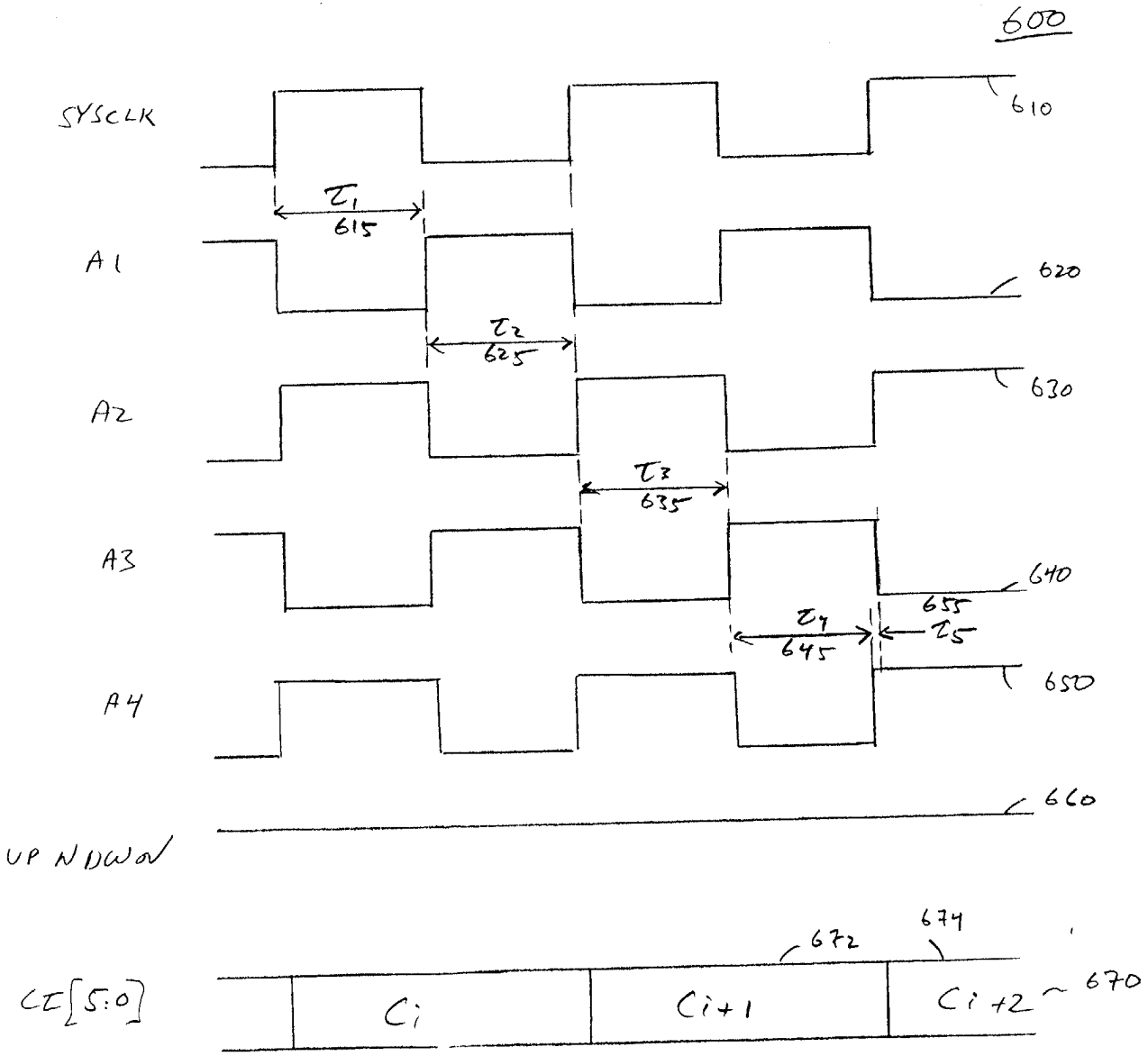


Figure 6

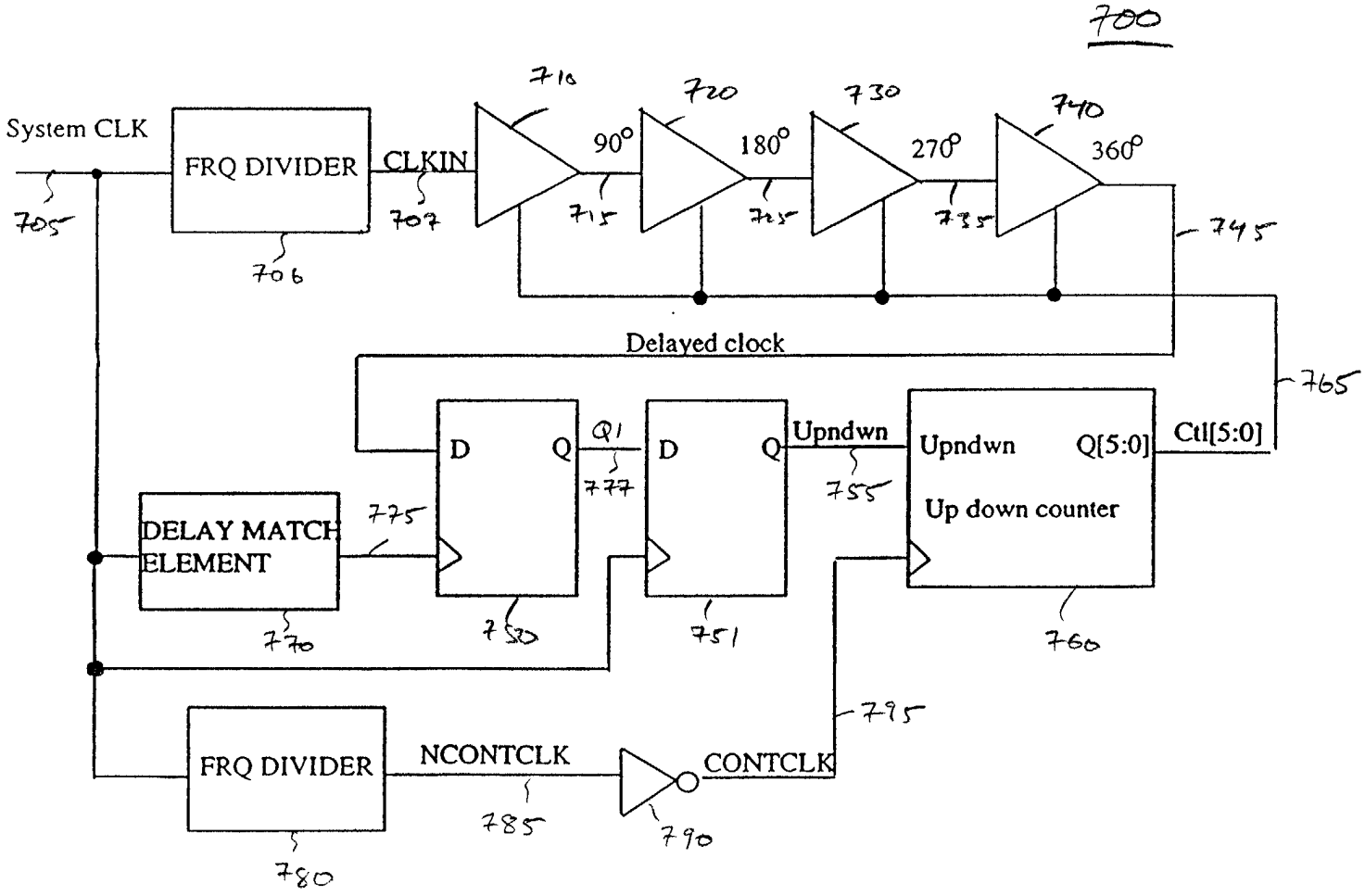

700
System CLK
FRQ DIVIDER
CLKIN
710
720
730
740
90°
180°
270°
360°
705
706
707
715
725
735
745
Delayed clock
765
D
Q
Q1
D
Q
Upndwn
Upndwn
Q[5:0]
Ctl[5:0]
Up down counter
DELAY MATCH ELEMENT
775
777
755
770
750
751
760
795
FRQ DIVIDER
NCONTCLK
CONTCLK
785
790
780

FIGURE 7

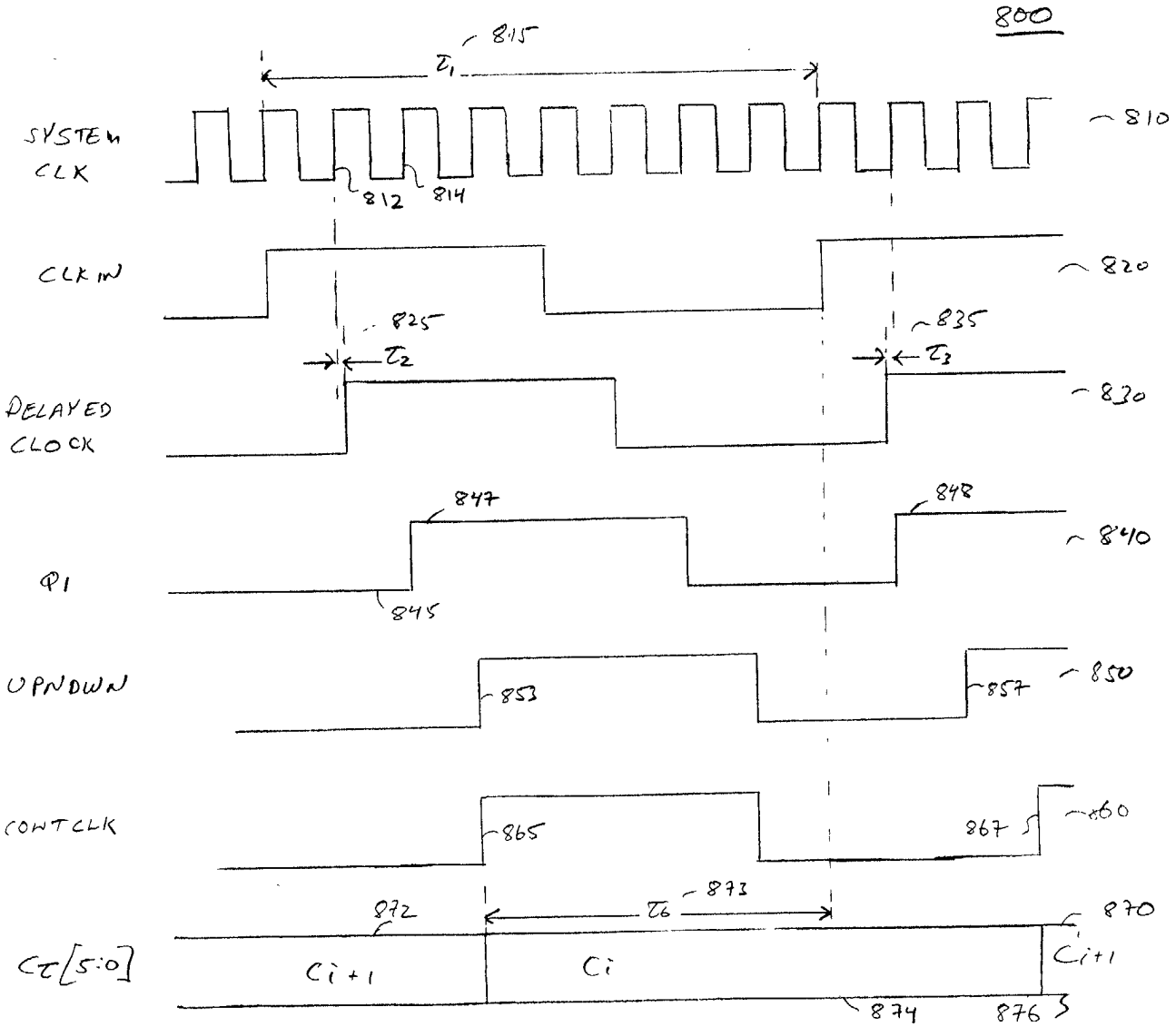

800
815
τ_1
SYSTEM CLK
810
812
814
CLK IN
820
825
835
τ_2
τ_3
DELAYED CLOCK
830
847
848
Φ1
840
845
UPNDWN
850
853
857
CONTCLK
860
865
867
872
873
τ_6
870
$C\tau[5:0]$
Ci+1
Ci
Ci+1
874
876

Figure 8

Docket No. 5681-00300

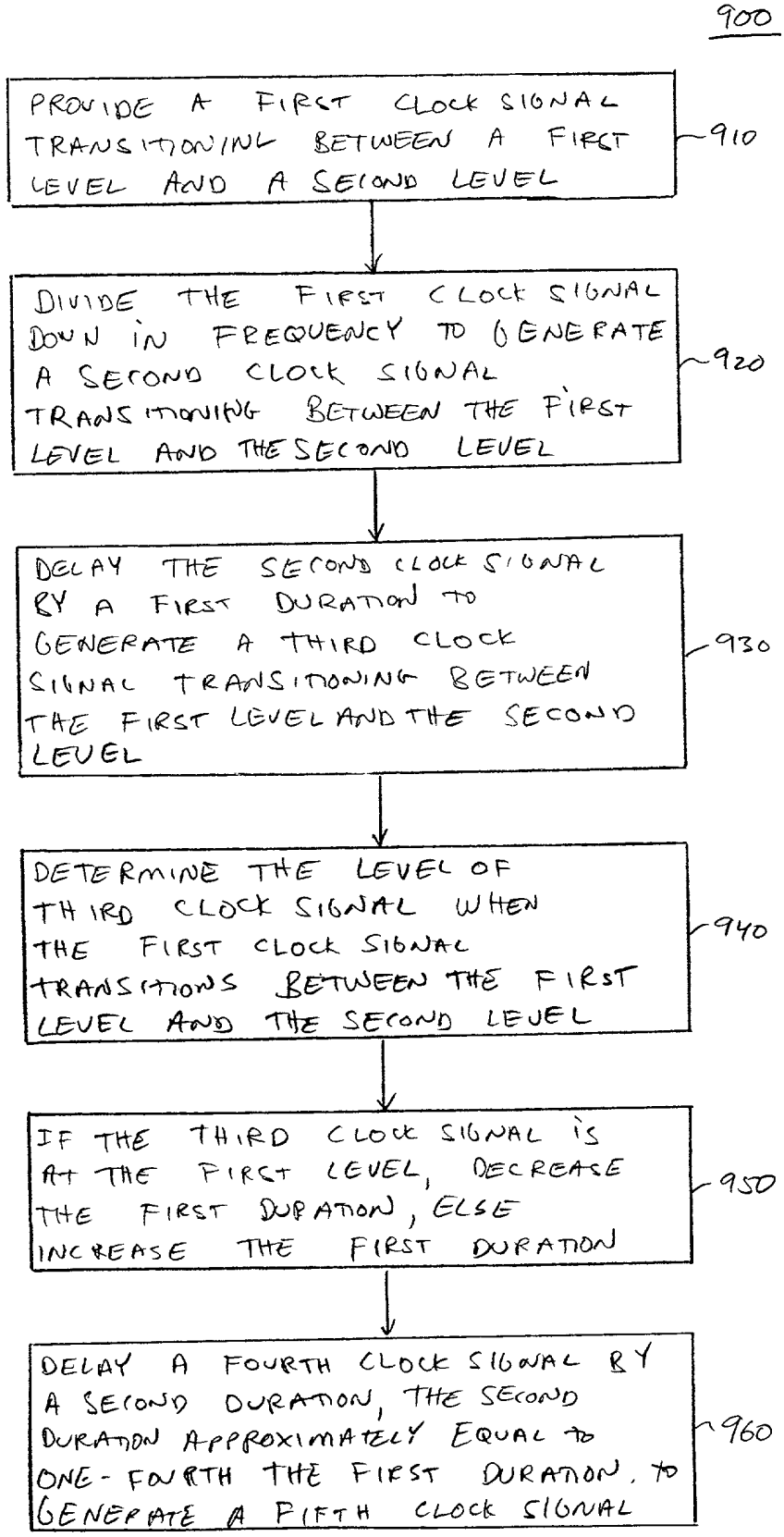


FIGURE 9

1000

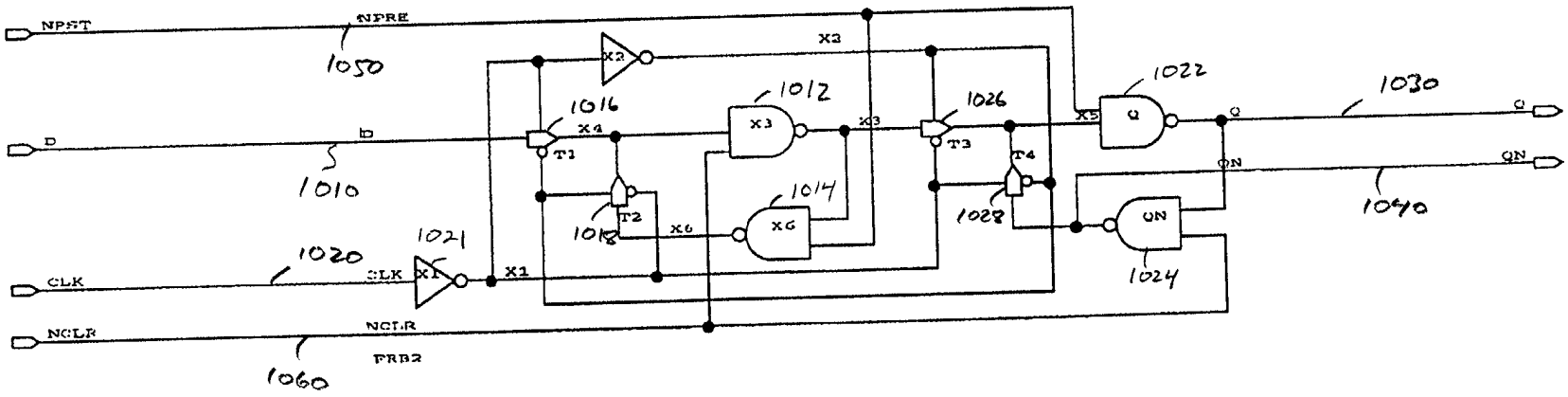


Figure 10

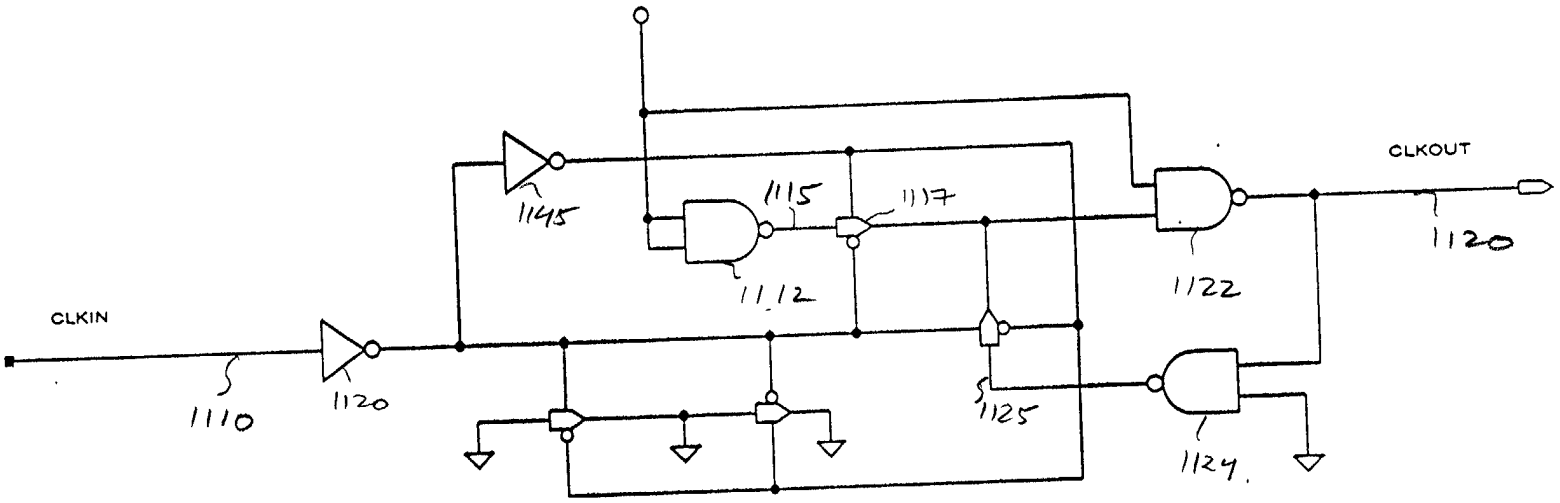

1100
CLKOUT
1120
1115
1117
1145
1112
1122
CLKIN
1110
1120
1125
1124

FIGURE 11

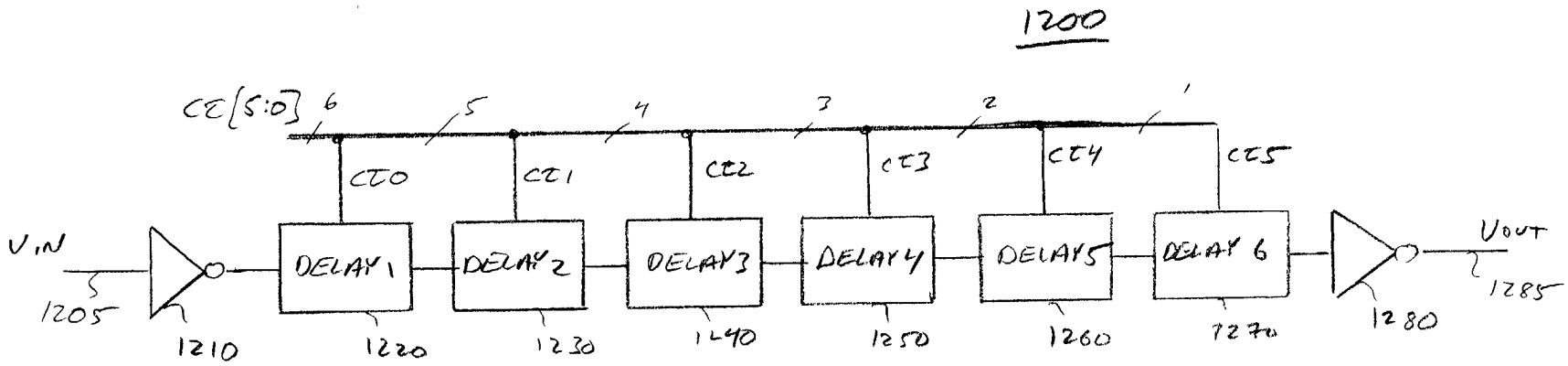

1200
CC[5:0]
6
5
4
3
2
1
CC0
CC1
CC2
CC3
CC4
CC5
VIN
1205
1210
DELAY 1
1220
DELAY 2
1230
DELAY 3
1240
DELAY 4
1250
DELAY 5
1260
DELAY 6
1270
1280
VOUT
1285

FIGURE 12

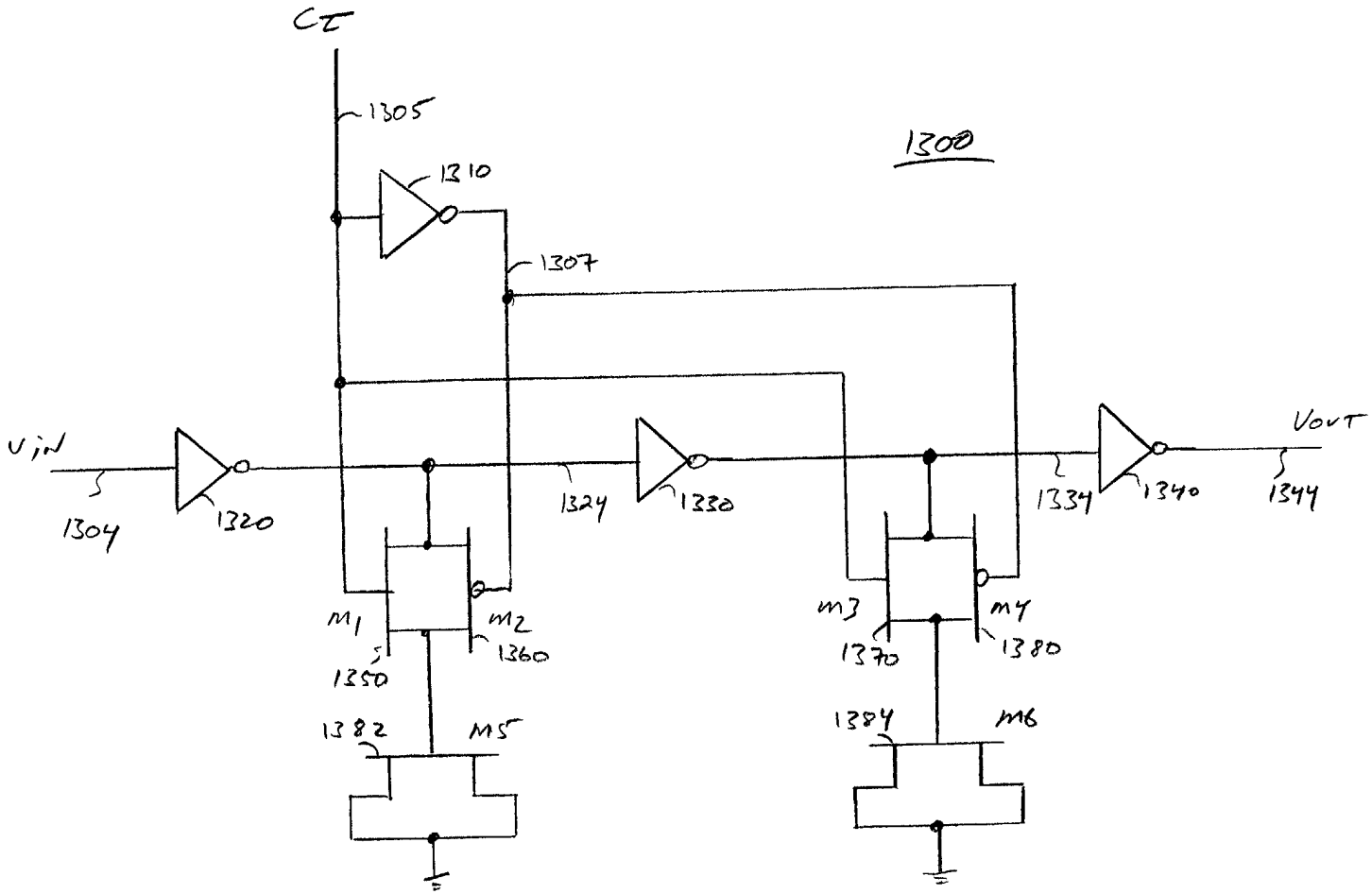

CE
1305
1300
1310
1307
Vin
1304
1320
1324
1330
1334
1340
Vout
1344
M1
1350
M2
1360
M3
1370
M4
1380
1382
M5
1384
M6

FIGURE 13

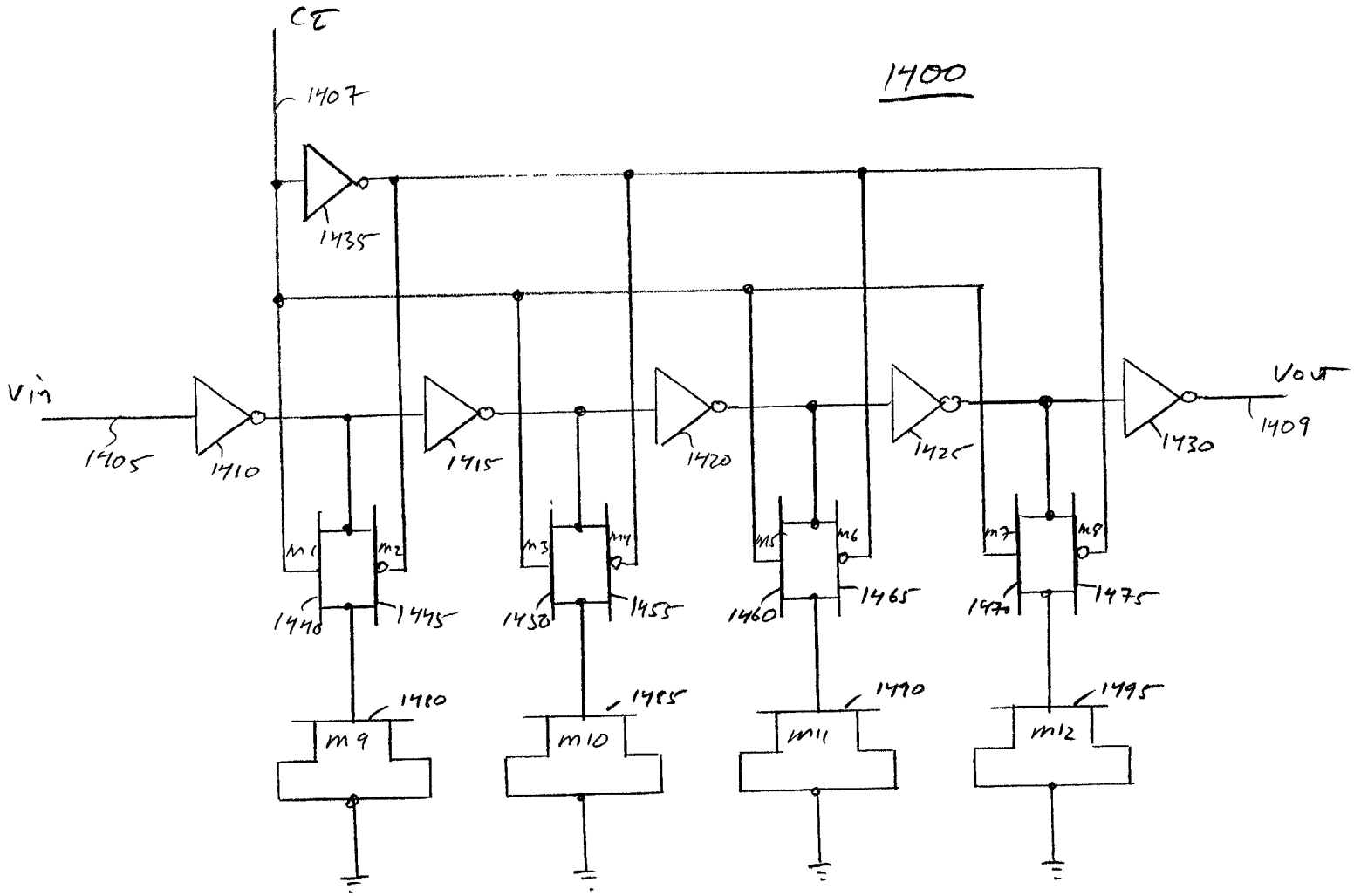
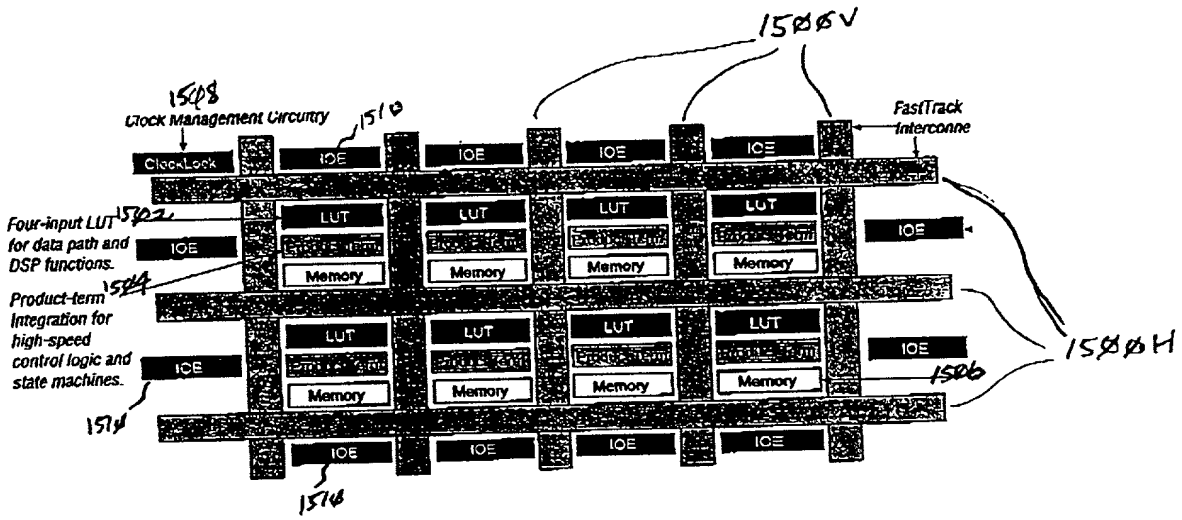
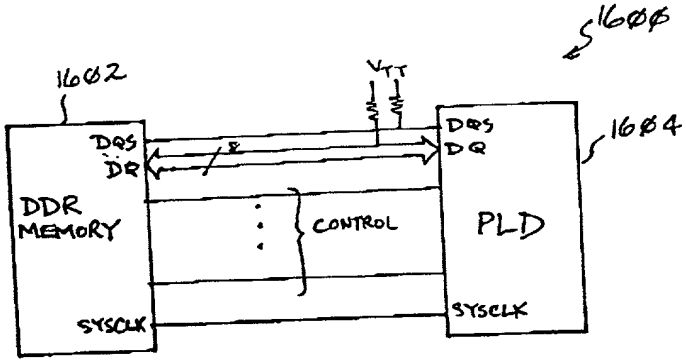

CE
1407
1400
1435
Vin
1405
1410
1415
1420
1425
1430
Vout
1409
m1
m2
m3
m4
m5
m6
m7
m8
1440
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
1495
m9
m10
m11
m12

FIGURE 14



- FIGURE 15 -



- FIGURE 16 -